

## PATENT ABSTRACTS OF JAPAN

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(54) RESIN COMPOSITION FOR FLAME RETARDANT MOLDING MATERIAL

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a resin composition for flame retardant molding materials having sufficient flame retardancy and workability.

SOLUTION: This resin composition for flame retardant molding materials comprises a radically polymerizable resin containing a phosphoric acid ester (meth)acrylate and aluminum hydroxide. The phosphorous atom content in the radically polymerizable resin is 0.7-10 wt.% based on the whole amount of the radically polymerizable resin. The phosphoric acid ester (meth)acrylate is at least one species selected from a group comprising phosphoric acid monoester (meth)acrylate, phosphoric acid diester (meth)acrylate and phosphoric acid triester (meth)acrylate and the relation among the molar ratio (M1) of phosphoric acid monoester (meth)acrylate, the molar ratio (M2) of phosphoric acid diester (meth)acrylate and the molar ratio (M3) of phosphoric acid triester (meth)acrylate is expressed by the following equations,  $1.5 \leq [(M1) \times 1 + (M2) \times 2 + (M3) \times 3] \leq 3$  and  $(M1) + (M2) + (M3) = 1$ .

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the resin constituent for fire-resistant molding materials suitably used as an ingredient of mold goods, such as a car and a machine part, building materials, a container, an electron and an electrical part, OA equipment, a precision instrument, a film, a sheet, and a pipe.

[0002]

[Description of the Prior Art] Since radical polymerization nature oligomer, such as unsaturated polyester, epoxy (meta) acrylate, urethane (meta) acrylate, and polyester (meta) acrylate, can give the physical properties which were excellent in various kinds after hardening when it is made into a radical hardening mold resin constituent using this, it has come to be utilized in the field of mold goods in recent years. Since the mold goods which are made to harden the resin constituent containing these radical polymerization nature oligomer, and are obtained essentially have the property as the organic substance to be easy to burn, when using for fields, such as building materials, they must give fire retardancy required to meet the fire prevention criteria etc., for example.

[0003] Using an aluminum hydroxide is known as a technique which gives fire retardancy to mold goods. This originates in the operation whose hydrated aluminum hydroxide emits water of crystallization at the time of combustion, and absorbs a heating value. However, in order to give fire retardancy sufficient by just blending an aluminum hydroxide with a resin constituent for mold goods, very a lot of aluminum hydroxides needed to be blended, and there were various problems in workability, the physical properties of mold goods, etc. as a resin constituent.

[0004] Then, the technique which uses together an aluminum hydroxide and the phosphoric ester which is a flame retarder to the resin constituent for molding materials is proposed. As for the phosphoric ester as a flame retarder, what esterified a phosphoric-acid compound and alcohols, such as a phosphoric anhydride and phosphorus oxychloride, is common. This phosphoric ester can make the coat of phosphorus oxide able to form in a front face according to a pyrolysis phase at the time of combustion, and can make mold goods discover fire retardancy according to the operation which covers the oxygen by that coat. Therefore, it is thought that the mold goods by the resin constituent for molding materials which blended an aluminum hydroxide and phosphoric ester can raise the fire retardancy of mold goods effectively according to a multiplication-operation with the operation which absorbs a heating value at the time of combustion, and the operation which covers the oxygen in a mold-goods front face.

[0005] However, generally, since such phosphoric ester is only added to the resin constituent, with time, phosphoric ester carries out bleeding to a mold-goods front face, there are the time of shaping and a possibility that fire retardancy uniform as mold goods may not be acquired, and the physical properties of mold goods, such as thermal resistance, and a water resisting property, an electrical property, may fall further again. Moreover, when an aluminum hydroxide and phosphoric ester of a certain kind were blended with the resin constituent at coincidence, the resin constituent caused the remarkable viscosity rise by these both interaction, the workability at the time of shaping will be remarkably inferior, and the

problem from which production of the mold goods in various kinds of applications becomes difficult also had it. Then, while blending an aluminum hydroxide and phosphoric ester and giving sufficient fire retardancy for mold goods, many physical properties for which mold goods, such as thermal resistance, and a water resisting property, an electrical property, are asked did not fall, but the resin constituent for fire-resistant molding materials which has still more sufficient workability was called for.

[0006]

[Problem(s) to be Solved by the Invention] This invention aims at offering the resin constituent for fire-resistant molding materials which has sufficient fire retardancy and sufficient workability in view of the above-mentioned present condition.

[0007]

[Means for Solving the Problem] The radical polymerization nature resin with which this invention contains phosphoric ester (meta) acrylate, Are the resin constituent for fire-resistant molding materials which comes to contain an aluminum hydroxide, and and the content of the Lynn atom in the above-mentioned radical polymerization nature resin It is 0.7 - 10 % of the weight to the radical polymerization nature resin whole quantity. The above-mentioned phosphoric ester (meta) acrylate Phosphoric-acid monoester (meta) acrylate, phosphoric-acid diester (meta) acrylate, And it is what consists of at least one sort chosen from the group which consists of trialkyl phosphate (meta) acrylate. The mole ratio (M1) of the above-mentioned phosphoric-acid monoester (meta) acrylate, the mole ratio of the above-mentioned phosphoric-acid diester (meta) acrylate (M2), And the mole ratio (M3) of the above-mentioned trialkyl phosphate (meta) acrylate is  $1.5 \leq [(M1) \times 1 + (M2) \times 2 + (M3) \times 3] \leq 3$  (however, it is  $(M1) + (M2) + (M3) = 1$ ). It is the resin constituent for fire-resistant molding materials which fills relation and which is a thing.

[0008] This invention is also the mold goods which come to fabricate the above-mentioned resin constituent for fire-resistant molding materials again. This invention is explained in full detail below.

[0009] The resin constituent for fire-resistant molding materials of this invention comes to contain radical polymerization nature resin and an aluminum hydroxide. The above-mentioned radical polymerization nature resin is a component hardened by the radical polymerization reaction in the resin constituent for fire-resistant molding materials of this invention. The above-mentioned radical polymerization nature resin contains phosphoric ester (meta) acrylate. The above-mentioned radical polymerization nature resin contains the Lynn atom. The content of the Lynn atom in the above-mentioned radical polymerization nature resin is 0.7 - 10 % of the weight to the radical polymerization nature resin whole quantity. If sufficient fire retardancy for mold goods cannot be given as it is less than 0.7 % of the weight, but it exceeds 10 % of the weight, the cost of a resin constituent will become high. It is 1.5 - 10 % of the weight more preferably.

[0010] In addition, in this specification, acrylate (meta) expresses acrylate or methacrylate and acryloyl (meta) expresses acryloyl or methacryloyl one.

[0011] The phosphoric ester (meta) acrylate in this invention The coat of phosphorus oxide is made to form in a front face according to a pyrolysis phase at the time of combustion of mold goods. It is what gives fire retardancy to mold goods according to the operation which covers the oxygen by the coat. Since it is incorporated by the resin frame by the polymerization reaction at the time of hardening of a resin constituent, there can be few possibilities of carrying out bleeding to the front face of mold goods, and uniform fire retardancy can be given to mold goods, and the operation can be demonstrated with time in mold goods. The above-mentioned phosphoric ester (meta) acrylate consists of at least one sort chosen from the group which consists of phosphoric-acid monoester (meta) acrylate, phosphoric-acid diester (meta) acrylate, and trialkyl phosphate (meta) acrylate.

[0012] As the above-mentioned phosphoric-acid monoester (meta) acrylate, the above-mentioned phosphoric-acid diester (meta) acrylate, and the above-mentioned trialkyl phosphate (meta) acrylate, although it will not be limited especially if it is the monomer which has an acryloyl (meta) radical in one piece, two pieces, and three phosphoric ester joint lists, the following etc. are mentioned, for example, respectively. These may be used independently, respectively and may use two or more sorts together.

[0013] As the above-mentioned phosphoric-acid monoester (meta) acrylate For example, monochrome

(2-(meta) acryloyloxyethyl) acid phosphate, Monochrome (2-(meta) acryloyloxypropyl) acid phosphate, Monochrome (3-(meta) acryloyloxypropyl) acid phosphate, Monochrome (3-(meta) acryloyl-2-hydroxyl oxy-propyl) acid phosphate, Monochrome (2-(meta) acryloyloxyethyl) methyl acid phosphate, monochrome (2-(meta) acryloyloxyethyl) ethyl acid phosphate, etc. are mentioned.

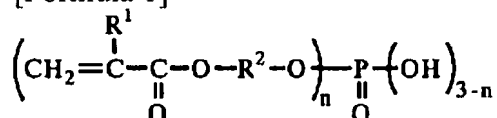
[0014] As the above-mentioned phosphoric-acid diester (meta) acrylate, JI (2-(meta) acryloyloxyethyl) acid phosphate, JI (2-(meta) acryloyloxypropyl) acid phosphate, JI (3-(meta) acryloyloxypropyl) acid phosphate, JI (3-(meta) acryloyl-2-hydroxyl oxy-propyl) acid phosphate, acid phosphate (2(3-(meta) acryloyloxypropyl)-(meta) acryloyloxyethyl), etc. are mentioned, for example.

[0015] As the above-mentioned trialkyl phosphate (meta) acrylate For example, Tori (2-(meta) acryloyloxyethyl) phosphate, Tori (2-(meta) acryloyloxypropyl) phosphate, Tori (3-(meta) acryloyloxypropyl) phosphate, Tori (3-(meta) acryloyl-2-hydroxyl oxy-propyl) phosphate, JI (3-(meta) acryloyl-2-hydroxyl oxy-propyl) (2-(meta) acryloyloxyethyl) phosphate, (3-(meta) acryloyl-2-hydroxyl oxy-propyl) JI (2-(meta) acryloyloxyethyl) phosphate etc. is mentioned.

[0016] Moreover, the compound which has the structure of monoester, diester, and triester in the same intramolecular can also be used. The following general formula since a possibility of producing combustible material at the time of combustion of mold goods becomes it is few and suitable [ the content of the Lynn atom in radical polymerization nature resin ] also in these;

[0017]

[Formula 1]



[0018] (R1 expresses a hydrogen atom or a methyl group among a formula.) R2 The divalent hydrocarbon chain of carbon numbers 1-10 and/or a -CH2 CH(OH) CH2-chain are expressed. n expresses the integer of 1-3. What is expressed is desirable.

[0019] The mole ratio (M1) of the above-mentioned phosphoric-acid monoester (meta) acrylate, the mole ratio of the above-mentioned phosphoric-acid diester (meta) acrylate (M2), And the mole ratio (M3) of the above-mentioned trialkyl phosphate (meta) acrylate is  $1.5 \leq [(M1) x1 + (M2) x2 + (M3) x3] \leq 3$  (however, it is  $(M1) + (M2) + (M3) = 1$ ). Relation is filled. The blending ratio of coal of phosphoric-acid monoester (meta) acrylate increases that the above-mentioned value is less than 1.5, since the interaction of phosphoric-acid monoester (meta) acrylate and an aluminum hydroxide is strong, the viscosity of a resin constituent will rise too much and the workability at the time of shaping will be inferior. It is  $1.6 \leq [(M1) x1 + (M2) x2 + (M3) x3] \leq 3.0$  more preferably. Preferably especially It is  $1.7 \leq [(M1) x1 + (M2) x2 + (M3) x3] \leq 3.0$ , and when mold goods are asked for the fire retardancy of a high level and the loadings of an aluminum hydroxide increase very much further,  $1.8 \leq [(M1) x1 + (M2) x2 + (M3) x3] \leq 3.0$  are desirable.

[0020] Thus, in the above-mentioned phosphoric ester (meta) acrylate, since the interaction of phosphoric ester (meta) acrylate and an aluminum hydroxide becomes moderate by lessening abundance of the above-mentioned phosphoric-acid monoester (meta) acrylate, the viscosity of a resin constituent becomes suitable and a resin constituent becomes the thing excellent in the workability at the time of shaping. In addition, in the above-mentioned phosphoric ester (meta) acrylate,  $M1 + M2 + M3$  are 1.

[0021] Although the hardenability resin constituent containing the resin constituent and ketone resin which consist of epoxy acrylate and a reactant monomer, and the acid phosphate compound which has one or more partial saturation monobasic-acid ester groups in a molecule is indicated by JP,51-125182,A, since this hardenability resin constituent assumes the coating which was suitable for covering a surface of metal as main applications, or the object for ink, in order to give fire retardancy, using together comparatively a lot of aluminum hydroxides is not indicated. Moreover, in the acid phosphate compound which has one or more partial saturation monobasic-acid ester groups applied, in order that lessening the ratio of monoester comparatively may not be indicated, either but it may give fire

retardancy sufficient as mold goods, when an aluminum hydroxide is blended comparatively so much, there is a possibility that the viscosity of a resin constituent may become remarkably high and workability may become low by the interaction of monoester and an aluminum hydroxide. For making mold goods into sufficient fire retardancy, since the content of the Lynn atom [ in / in the resin constituent for fire-resistant molding materials of this invention / radical polymerization nature resin ] is a complement, it can give sufficient fire retardancy for mold goods with combination with an aluminum hydroxide. Moreover, in phosphoric ester (meta) acrylate, since phosphoric-acid monoester (meta) acrylate contains at a comparatively low rate and the interaction with an aluminum hydroxide is moderate, the viscosity of a resin constituent becomes suitable and the resin constituent for fire-resistant molding materials becomes the thing excellent in the workability at the time of shaping.

[0022] Usually, phosphoric ester (meta) acrylate can esterify phosphoric-acid compounds, such as a phosphoric anhydride and phosphorus oxychloride, by hydroxyalkyl (meta) acrylate, glycidyl (meta) acrylate, etc., and can obtain a phosphoric-acid compound easily as mixture, such as one permutation, two permutations, and a thing permuted three times, respectively. Then, as phosphoric ester (meta) acrylate, as the abundance of phosphoric-acid monoester (meta) acrylate, phosphoric-acid diester (meta) acrylate, and trialkyl phosphate (meta) acrylate was mentioned above, sufficient fire retardancy for mold goods can be given by making it suitable, and a resin constituent becomes the thing excellent in the workability at the time of shaping.

[0023] In the radical polymerization nature resin in this invention as a radical polymerization nature compound of others other than phosphoric ester (meta) acrylate Especially if it consists of what has a radical polymerization nature machine in intramolecular, and can carry out a polymerization reaction with phosphoric ester (meta) acrylate, will not be limited, but since it shall have fundamentality ability with sufficient mold goods It is desirable that it is what consists of mixture of radical polymerization nature oligomer and a radical polymerization nature monomer.

[0024] Although not limited especially as the above-mentioned radical polymerization nature oligomer, while having two or more radical polymerization nature machines in intramolecular, that whose number average molecular weight (Mn) is 500 or more is desirable. There is a possibility that mold goods may be inferior to fundamentality ability, such as reinforcement, in the number of the radical polymerization nature machines of intramolecular being one, or number average molecular weight (Mn) being less than 500. Number average molecular weight (Mn) is 8000 or less more preferably from the viscosity of a resin constituent becoming suitable and a resin constituent becoming the thing excellent in the workability at the time of shaping. While having two or more radical polymerization nature machines in intramolecular, it is not limited especially as that whose number average molecular weight (Mn) is 500 or more, for example, unsaturated polyester, epoxy (meta) acrylate, urethane (meta) acrylate, polyester (meta) acrylate, etc. are mentioned. These may be used independently and may use two or more sorts together.

[0025] It will not be limited especially if it is the monomer which can carry out a polymerization reaction with the thing in radical polymerization nature oligomer or phosphoric ester (meta) acrylate as the above-mentioned radical polymerization nature monomer. For example, styrene, alpha methyl styrene, vinyltoluene, a divinylbenzene, Diallyl phthalate, N-vinyl pyrrolidone, the diethylene-glycol divinyl ether, Methyl (meta) acrylate, ethyl (meta) acrylate, butyl (meta) acrylate, Methoxy ethylene glycol (meta) acrylate, 2-phenoxy ethyl (meta) acrylate, JISHIKURO pentenyl oxy-ethyl (meta) acrylate, ethylene glycol di(metha)acrylate, Propyleneglycol di(meth) acrylate, 1,6-hexanediol di(metha) acrylate, TORIMECHI roll pro pantry (meta) acrylate, etc. are mentioned. These may be used independently and may use two or more sorts together.

[0026] Although not limited especially as abundance of the above-mentioned radical polymerization nature oligomer and the above-mentioned radical polymerization nature monomer, it is desirable that it is 2 / 8 - 9/1. While the viscosity of a resin constituent becomes it high that it is a rate with much radical polymerization nature oligomer and workability falls rather than 9/1, there is a possibility that hardenability may fall and fundamentality ability, such as reinforcement of mold goods, may fall that radical polymerization nature oligomer is few rates rather than two eighths. It is 4 / 6 - 8/2 more

preferably.

[0027] Although not limited especially as abundance of the above-mentioned phosphoric ester (meta) acrylate and the above and other radical polymerization nature compounds in case the above-mentioned radical polymerization nature resin contains the above and other radical polymerization nature compounds, the above-mentioned phosphoric ester (meta) acrylate is 5 - 80 % of the weight to the above-mentioned radical polymerization nature resin whole quantity, and it is desirable that the above and other radical polymerization nature compounds are 20 - 95 % of the weight. There is a possibility that the fire retardancy of mold goods may fall if phosphoric ester (meta) acrylate is less than 5 % of the weight or other radical polymerization nature compounds exceed 95 % of the weight, and when phosphoric ester (meta) acrylate exceeds 80 % of the weight or other radical polymerization nature compounds are less than 20 % of the weight, there is a possibility that fundamentality ability, such as reinforcement of mold goods, may fall. More preferably, the above-mentioned phosphoric ester (meta) acrylate is 10 - 60 % of the weight, and the above and other radical polymerization nature compounds are 40 - 90 % of the weight.

[0028] The aluminum hydroxide in this invention is for having the operation which absorbs a heating value at the time of combustion of mold goods, and giving fire retardancy in multiplication to mold goods with phosphoric ester (meta) acrylate. As for the content of the above-mentioned aluminum hydroxide, it is desirable that it is the 100 - 300 weight section to the above-mentioned radical polymerization nature resin 100 weight section. When there is a possibility that sufficient fire retardancy for mold goods cannot be given as they are under the 100 weight sections and the 300 weight sections are exceeded, there is a possibility that fundamentality ability of mold goods, such as flexibility, may fall.

[0029] In order to raise fundamentality ability, such as reinforcement of mold goods, inorganic bulking agents other than an aluminum hydroxide and strengthening fiber can be blended with the resin constituent for fire-resistant molding materials of this invention. It is not limited especially as the above-mentioned inorganic bulking agent, for example, a calcium carbonate, a barium sulfate, an alumina, metal powder, kaolin clay, talc, a milled fiber, silica sand, diatomaceous earth, a crystalline silica, fused silica, glass powder, etc. are mentioned. These may be used independently and may use two or more sorts together. It is not limited especially as the above-mentioned strengthening fiber, for example, organic fiber, such as inorganic fiber; Vinyon, such as a glass fiber and a carbon fiber, a phenol, Teflon, aramid, and polyester, etc. is mentioned. These may be used independently and may use two or more sorts together. It is not limited especially as a configuration of the above-mentioned strengthening fiber, for example, the shape of a mat-like; chop-like; roving-like; nonwoven fabric, such as a cross; chop strand mat, a PURIFOMABURU mat, a conte nuance strand mat, and a surfacing mat, etc. is mentioned.

[0030] A flame retarder can be blended with the resin constituent for fire-resistant molding materials of this invention in order to raise the fire retardancy of mold goods further. What is not limited especially as the above-mentioned flame retarder, for example, is usually used for the resin constituent for fire-resistant molding materials is mentioned. These may be used independently and may use two or more sorts together. Also in these, in order that mold goods may not cause the environmental pollution by dioxin at the time of combustion, the flame retarder which does not have a halogen atom in a molecule is desirable. Especially as a flame retarder which does not have a halogen atom, it is not limited into the above-mentioned molecule, for example, boric-acid compounds, such as Lynn amino conjugated compound; boric-acid zinc, such as amino-compound; melamine phosphate, such as phosphorus-compounds; melamines [, such as phosphoric ester; ammonium polyphosphate, ], such as triphenyl phosphate, cresyl diphenyl phosphate, and resorcinol diphenyl phosphate, benzoguanamine, and guanidine, and guanidine phosphate, and boric-acid aluminum, etc. are mentioned.

[0031] Other resin, the additive for molding materials, etc. can be blended with the resin constituent for fire-resistant molding materials of this invention for improvement, such as the dispersibility of a resin constituent, a moldability, and fundamentality ability of mold goods. In order to raise the cure rate at the time of shaping to the resin constituent for fire-resistant molding materials of this invention and to

improve manufacture effectiveness, it is desirable to add a curing agent. Moreover, a hardening accelerator can also be added in order to adjust hardenability. Although you may add to the resin constituent for fire-resistant molding materials beforehand, and you may add in case it is made to harden, as for the above-mentioned curing agent and the above-mentioned hardening accelerator, it is desirable to set up the stage added in consideration of the pot life of a resin constituent.

[0032] It is not limited especially as the above-mentioned curing agent, for example, organic peroxide; azo compounds, such as benzoyl peroxide, t-butyl peroxybenzoate, methyl ethyl ketone peroxide, dicumyl peroxide, t-butyl hydro peroxide, and cumene hydro peroxide, etc. are mentioned. These may be used independently and may use two or more sorts together. Although not limited especially as an addition of the above-mentioned curing agent, 0.05 - 10 % of the weight is desirable to the resin constituent 100 weight section for fire-resistant molding materials. When there is a possibility that the cure rate of a resin constituent may become slow and may be inferior to manufacture effectiveness when fewer than 0.05 % of the weight and it exceeds 10 % of the weight, there is a possibility that the cure rate of a resin constituent may become quick too much, and may be inferior to workability.

[0033] Bleeding of the phosphoric ester (meta) acrylate in the resin constituent for fire-resistant molding materials of this invention can be carried out to neither the time of shaping, nor a target with the passage of time on a mold-goods front face, but it can give uniform fire retardancy to mold goods. Moreover, water of crystallization is emitted by the aluminum hydroxide at the time of combustion of mold goods, in the pyrolysis phase of resin, the coat of phosphorus oxide is formed in a front face of phosphoric ester (meta) acrylate, and the resin constituent for fire-resistant molding materials of this invention has the operation which covers oxygen while having the operation which absorbs a heating value. And since the interaction of an aluminum hydroxide and phosphoric ester is moderate, the viscosity of a resin constituent becomes suitable and it becomes the thing excellent in the workability at the time of shaping. Therefore, the resin constituent for fire-resistant molding materials of this invention becomes the thing excellent in the workability at the time of shaping while it can utilize effectively the operation which an aluminum hydroxide and phosphoric ester (meta) acrylate do so and can give sufficient fire retardancy for mold goods.

[0034] The resin constituent for fire-resistant molding materials of this invention can be suitably used as an ingredient of the mold goods of an application with which the fire retardancy of a car and a machine part, building materials, a container, an electron and an electrical part, OA equipment, a precision instrument, a film, a sheet, a pipe, etc. is demanded.

[0035] The mold goods of this invention come to fabricate the resin constituent for fire-resistant molding materials of this invention. The above-mentioned shaping can be performed by hardening a resin constituent according to the usual shaping approach and a process condition. The above-mentioned mold goods have sufficient fire retardancy, and moreover, since the resin constituent for fire-resistant molding materials is excellent in the workability at the time of shaping, they are easy to fabricate, and they can use it for various kinds of applications. The above-mentioned mold goods are also one of this inventions.

[0036]

[Example] Although an example is hung up over below and this invention is explained to it in more detail, this invention is not limited only to these examples.

[0037] The ARARUDAIDO GY-250 (trade name, bisphenol mold epoxy compound [ of the average weight per epoxy equivalent 185 ], Ciba Specialty Chemicals make) 370 weight section, the methacrylic-acid 172 weight section, the hydroquinone 0.10 weight section, and the triethylamine 2.3 section were taught by using the 4 opening flask equipped with example of preparation 1 thermometer, an agitator, gas blowing-in tubing, and a reflux cooling pipe as a reaction container. Subsequently, it reacted at 115 degrees C for 6.5 hours, stirring this mixture in an air air current, and the epoxy methacrylate whose acid number is 4.5 mgKOH/g and whose number average molecular weight (Mn) is 940 was obtained. To this, further, the styrene 232 weight section, the monochrome (2-methacryloiloxy-ethyl) acid phosphate 48 weight section, and the JI (2-methacryloiloxy-ethyl) acid phosphate 124 weight section were blended, and radical polymerization nature resin (1) was obtained. The content of the Lynn

atom of the obtained radical polymerization nature resin was shown in Table 1.

[0038] Epoxy methacrylate was obtained like the example 1 of example of preparation 2 preparation. To this, further, the styrene 232 weight section and the JI (2-methacryloiloxy-ethyl) (3-methacryloyl-2-hydroxyl oxy-propyl) phosphate 380 weight section were blended, and radical polymerization nature resin (2) was obtained. The content of the Lynn atom of the obtained radical polymerization nature resin was shown in Table 1.

[0039] The ARARUDAIDO GY-250 (trade name) 370 weight section, the hiker CTBN1300x8 (trade name, carboxyl group content acrylonitrile butadiene, BFGoodrich (BF Goodrich) make) 90 weight section, the methacrylic-acid 168 weight section, the hydroquinone 0.10 weight section, and the triethylamine 2.3 weight section were taught to the same reaction container as the example 1 of example of preparation 3 preparation. Subsequently, it reacted at 115 degrees C for 7.5 hours, stirring this mixture in an air air current, and the epoxy methacrylate whose acid number is 6.0 mgKOH/g and whose number average molecular weight (Mn) is 1560 was obtained. To this, further, the styrene 269 weight section, the monochrome (2-methacryloiloxy-ethyl) acid phosphate 56 weight section, and the JI (2-methacryloiloxy-ethyl) acid phosphate 143 weight section were blended, and radical polymerization nature resin (3) was obtained. The content of the Lynn atom of the obtained radical polymerization nature resin was shown in Table 1.

[0040] Epoxy methacrylate was obtained like the example 1 of example of comparison preparation 1 preparation. To this, further, the styrene 232 weight section, the monochrome (2-methacryloiloxy-ethyl) acid phosphate 112 weight section, and the JI (2-methacryloiloxy-ethyl) acid phosphate 17 weight section were blended, and comparison radical polymerization nature resin (1) was obtained. The content of the Lynn atom of the obtained comparison radical polymerization nature resin was shown in Table 2.

[0041] Epoxy methacrylate was obtained like the example 1 of example of comparison preparation 2 preparation. To this, further, the styrene 232 weight section, the monochrome (2-methacryloiloxy-ethyl) acid phosphate 8.2 weight section, and the JI (2-methacryloiloxy-ethyl) acid phosphate 20.8 weight section were blended, and comparison radical polymerization nature resin (2) was obtained. The content of the Lynn atom of the obtained comparison radical polymerization nature resin was shown in Table 2.

[0042] radical polymerization nature resin (1) - (3) obtained in the examples 1-3 of example preparation -- resin constituent for fire-resistant molding materials (1) - (3) was obtained, respectively by adding the HAIJI light H-32I(trade name, Showa Denko K.K. make) 150 weight section to the 100 weight sections as an aluminum hydroxide, and stirring to homogeneity, respectively. The loadings of the radical polymerization nature resin in the obtained resin constituent for fire-resistant molding materials and an aluminum hydroxide and the value of  $[(M1) \times 1 + (M2) \times 2 + (M3) \times 3]$  of phosphoric ester (meta) acrylate were shown in Table 1. The obtained resin constituent for fire-resistant molding materials (1) - (3) constituent [ resin ] for fire retardancy molding materials which added curing agent (1) - (3) were obtained, respectively by adding the par butyl Z(trade name, Nippon Oil & Fats Co., Ltd. make) 1.0 weight section to the 250 weight sections as a curing agent, and mixing to homogeneity, respectively. Subsequently, the resin constituent for fire-resistant molding materials which added the curing agent is poured in into the case of the glass plate which sandwiched the 3mm spacer, respectively, and among a hot blast circuit system drying furnace and after making it harden for 30 minutes at 100 degrees C, it was made to harden for 30 minutes at 175 more degrees C. It cooled to the room temperature after hardening, the glass plate was removed, and mold-goods (1) - (3) was obtained, respectively. The evaluation approach shown below estimated the resin constituent for fire-resistant molding materials and mold goods which were obtained. The result was indicated to Table 1.

[0043] the resin constituent for viscosity profit \*\*\*\* fire retardancy molding materials of an evaluation approach (1) resin constituent -- a BROOKFIELD (HELIPATH SPINDLE mold) viscometer -- using -- 30-degree C constant temperature -- viscosity (mPa-s) was measured in the bottom.

(2) the fire-resistant profit \*\*\*\* mold goods of mold goods were cut into the strip of paper with a die length [ of 70mm ], and a width of face of 6.5\*\*0.5mm, and were used as the fire-resistant test piece. The fire-resistant evaluation approach is JIS. K Based on 7201 (1995) "the combustion test approach of the polymeric materials by the oxygen-index method", it carried out by the oxygen index. An oxygen



index is an index showing fire retardancy, and is a numeric value of the minimum oxygen density expressed with capacity % of mixed gas required for an ingredient to maintain combustion under a predetermined test condition, self-extinguishing cannot burn easily highly and a numerical large thing can say that fire retardancy is high.

[0044]

[Table 1]

		実施例		
		難燃性成形材料用樹脂組成物		
		(1)	(2)	(3)
ラジカル重合性樹脂のリン原子の含有量 (重量%)		2.0	2.2	2.0
難燃性成形材料用 樹脂組成物の配合 (重量部)	ラジカル重合性樹脂	100	100	100
	水酸化アルミニウム	150	150	150
$[(M1) \times 1 + (M2) \times 2 + (M3) \times 3]$		1.63	3.00	1.62
難燃性成形材料用樹脂組成物の粘度 (mPa·s)		8500	7000	8800
成形品の難燃性 酸素指数		成形品		
		(1)	(2)	(3)
		45	45	47

[0045] The resin constituent for comparison molding materials (1) which added the curing agent, and (2) were obtained like the example, respectively, using respectively the comparison radical polymerization nature resin (1) obtained in the examples 1 and 2 of example comparison preparation of a comparison, and (2). Moreover, the resin constituent for comparison molding materials (3) which added the curing agent was obtained by adding the par butyl Z(trade name) 1.0 weight section to the resin constituent (3) 100 weight section for comparison molding materials as a curing agent by using as the resin constituent for comparison molding materials (3) what does not add an aluminum hydroxide to the radical polymerization nature resin (1) obtained in the example 1 of preparation, and mixing to homogeneity. The loadings of the radical polymerization nature resin in the obtained resin constituent for comparison molding materials and an aluminum hydroxide and the value of  $[(M1) \times 1 + (M2) \times 2 + (M3) \times 3]$  of phosphoric ester (meta) acrylate were shown in Table 2. Subsequently, like the example, comparison mold-goods (1) - (3) was obtained, respectively, and the resin constituent for comparison molding materials and comparison mold goods were evaluated. The result was indicated to Table 2.

[0046]

[Table 2]

		比較例		
		比較成形材料用樹脂組成物		
		(1)	(2)	(3)
比較ラジカル重合性樹脂のリン原子の含有量 (重量%)		2.0	0.4	2.0
比較成形材料用 樹脂組成物の配合 (重量部)	比較ラジカル重合性樹脂	100	100	100
	水酸化アルミニウム	150	150	0
[(M1) × 1 + (M2) × 2 + (M3) × 3]		1.09	1.62	1.63
比較難燃性成形材料用 樹脂組成物の粘度 (mPa・s)		24800	7000	—
比較成形品の難燃性 酸素指数		比較成形品		
		(1)	(2)	(3)
		44	32	30

[0047] In the example, resin constituent for fire-resistant molding materials (1) - (3) is moderate viscosity, and had sufficient workability at the time of shaping so that clearly from Table 1. On the other hand, since the value of [(M1) × 1 + (M2) × 2 + (M3) × 3] was 1.1 in the resin constituent for comparison molding materials (1) in the example of a comparison, it is remarkable high viscosity and workability was inferior at the time of shaping, so that clearly from Table 2. In the resin constituent for comparison molding materials (2), since the content of the Lynn atom of comparison radical polymerization nature resin was as low as 0.4 % of the weight, an oxygen index is in a low value and fire retardancy was inferior. In the resin constituent for comparison molding materials (3), since there was no synergism of an aluminum hydroxide and phosphoric ester, an oxygen index is in a low value and fire retardancy was inferior.

[0048]

[Effect of the Invention] Since the resin constituent for fire-resistant molding materials of this invention consists of an above-mentioned configuration, it has sufficient fire retardancy, and moreover, it is moderate viscosity and the workability at the time of shaping is excellent. The mold goods of this invention have sufficient fire retardancy, and, moreover, can use it for various kinds of applications from shaping being easy.

[Translation done.]